

1. Report No. CG-D-09-03		2. Government Accession Number ADA418156		3. Recipient's Catalog No.	
4. Title and Subtitle Use of Coastal Ocean Dynamics Application Radar (CODAR) Technology in U. S. Coast Guard Search and Rescue Planning				5. Report Date June 2003	
				6. Performing Organization Code Project No. 1013	
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				11. Contract or Grant No. DTCG32-02-F-200004	
12. Sponsoring Organization Name and Address  U.S. Department of Homeland Security United States Coast Guard Operations (G-O) Washington, DC 20593-0001				13. Type of Report & Period Covered Final	
				14. Sponsoring Agency Code Commandant (G- OPR) U.S. Coast Guard Headquarters Washington, DC 20593-0001	
15. Supplementary Notes The R&D Center's technical point of contact is Mr. Art Allen, 860-441-2747, email: aallen@rdc.uscg.mil.					
16. Abstract (MAXIMUM 200 WORDS)  This project looked at CODAR technology with the objective of providing accurate and reliable surface current data as a primary input into the SAR planning process. The two key products developed in this project include a Short Term Predictive System (STPS) for predicting surface currents based on historical CODAR current measurements, and an Interactive Web Site to facilitate access to CODAR current data and demonstrate applicability to SAR planning.  Drift trajectories that can be obtained using these products were compared with actual trajectories of Self-Locating Datum Marker Buoys (SLDMB) to assess and evaluate the applicability of CODAR technology to Coast Guard SAR planning relative to currently used environmental data sources.  Comparison of SLDMB trajectory predictions with actual SLDMB trajectories has shown that CODAR currents and STPS-predicted currents are clearly superior to National Oceanographic and Atmospheric Administration (NOAA) tidal current predictions for the purpose of predicting drift trajectories in near-coastal applications.					
17. Key Words CODAR, Coastal Ocean Dynamics Application Radar, Surface Current, Drift Trajectory, Search and Rescue Planning			18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, VA 22161		
19. Security Class (This Report) UNCLASSIFIED		20. Security Class (This Page) UNCLASSIFIED		21. No of Pages	
				22. Price	

## **EXECUTIVE SUMMARY**

CODAR is a shore-based high-frequency (HF) surface radar system that can be used to measure surface currents up to 200 km from shore. First developed in the 1960s, it was difficult to run and maintain. However, with the advent of the Internet and high-speed computers, processing of the extensive data associated with CODAR and coordination of several installations required for large-scale coverage are now possible.

Coastal Ocean Dynamics Application Radar (CODAR) represents a mature technology that has been available for use since the 1960s. The number of operational CODAR sites is on the increase, due partly to recent advances in broadband data communication. The rapid rate of CODAR growth has precipitated another look at how CODAR data can be employed for Search and Rescue (SAR) planning.

This project looked at CODAR technology, where it is, and where it is going, with the objective of providing accurate and reliable surface current data as a primary input into the SAR planning process. The two key products developed in this project include a Short Term Predictive System (STPS) for predicting surface currents based on historical CODAR current measurements and an Interactive Web Site to facilitate access to CODAR current data and demonstrate applicability to SAR planning.

Drift trajectories that can be obtained using these products were compared with actual trajectories of Self-Locating Datum Marker Buoys (SLDMB) to assess and evaluate the applicability of CODAR technology to Coast Guard SAR planning relative to currently used environmental data sources.

Based on these investigations, an assessment has been made regarding the applicability of CODAR data to SAR planning efforts, and specific recommendations are presented to advance the use of CODAR data in SAR planning.

### **Conclusions**

Current Coast Guard SAR planning tools rely on empirical analyses of surface current observations and are severely limited by the fact that current observations in the coastal ocean are sparse. An opportunity exists to capitalize on the many CODAR systems that are being made operational nationwide and to improve the quality of the environmental data the Coast Guard SAR planning process relies upon, as supported by the following conclusions presented in this report:

- Uninterrupted coverage will soon be available for the entire Northeast coast by both short-range and long-range CODAR systems. As a result, surface current vector data will be widely available at temporal and spatial resolutions superior to data currently used by the Coast Guard.
- Motivation for extensive CODAR system deployment is being driven by organizational needs outside the Coast Guard; consequently, coverage sufficient for Coast Guard use will be developed with minimal direct investment by the Coast Guard.

- Comparison of SLDMB trajectory predictions with actual SLDMB trajectories has shown that CODAR currents and STPS-predicted currents are clearly superior to National Oceanographic and Atmospheric Administration (NOAA) tidal current predictions for the purpose of predicting drift trajectories in near-coastal applications.
- Although the STPS-predicted currents are superior to the NOAA tidal current predictions for trajectory prediction, in their present immature state they are still significantly worse than the actual CODAR observations.

While CODAR data is demonstrably superior to data currently used by the Coast Guard, it is not currently available by accessing a single source. To be effectively employed by Coast Guard planning tools, a single data source of CODAR-based environmental data is required to deliver the most accurate environmental data that can be derived from available sources. Many of the issues addressed in this project remain unresolved, and further study is needed to effectively characterize and correlate the data quality available from the CODAR sources coming on-line.

### **Recommendations**

Continued analysis of CODAR data, predictive capabilities, and access methods is recommended, based on the potential improvement to be gained from the higher quality data that can be made available. Specific areas for future investigation include:

- **CODAR Data Analysis** – To develop a better understanding of CODAR data and improve data product accuracy, further analysis and comparison of the deployed SLDMB data with the measured and predicted CODAR data is required. Include a systematic comparison of SLDMB and CODAR velocities to better understand inherent uncertainties and their impact on search area determination.
- **STPS Algorithm Improvements** – To advance the STPS algorithm and improve forecasting accuracy, a second-generation STPS algorithm needs to be developed that integrates wind forecast data. Base development on an analysis of how wind measurements are correlated with CODAR measured currents, and modify the current Gauss-Markov method to include those effects.
- **Interactive Web Site Improvements** – To demonstrate data availability from multiple CODAR sites and establish a method for data aggregation within and between adjacent CODAR regions, the coverage of the Web Site interface needs to be expanded to include components from other CODAR sites, and the solutions enhanced to provide Monte Carlo-style calculation of trajectories. Include solution implementation improvements based on the understanding gained from further CODAR data analysis.
- **Evaluate Operational Impact of CODAR Data** – To demonstrate potential SAR planning improvements and obtain feedback necessary to integrate CODAR data into operational search plans, an operational demonstration using the Interactive Web Site is recommended to coincide with the 2004 SAR season.

The Coast Guard is in the process of developing improved tools for SAR planning that will incorporate the most promising drift and search area methods that have been investigated. A direct link should be established between follow-on tasking arising from these recommendations and SAR planning tool development efforts.